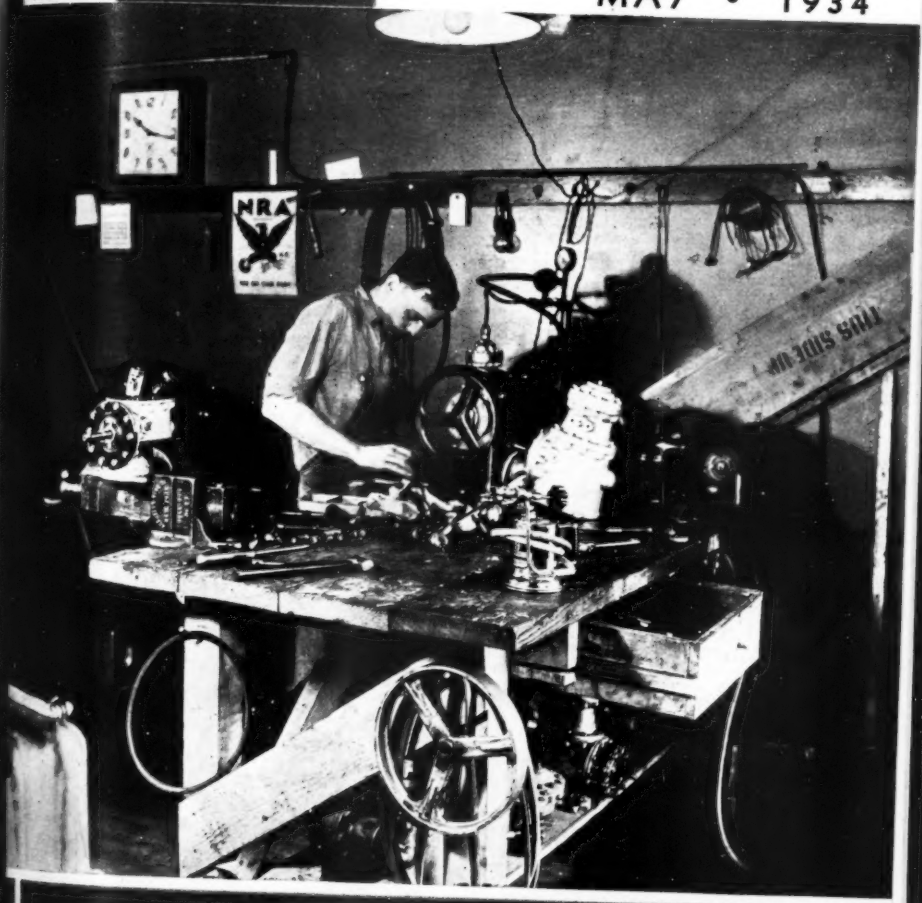
62

The Refrigeration Service Engineer

Vol. 2
No. 5

MAY • 1934



Air Conditioning—Refrigerant Controls
Milk Cooling—Restaurant Refrigeration
Reconditioning Tools—The Question Box

SERVICE = *When and As You Need It!*

Over-night Express Delivery to All Points Within Circle. Coil Shipments Almost Always on Day of Receipt of Order Even on "Specials"

Unit Coolers
Condensers
Commercial Evaporators
Finned and Bare Tube Shelf Coils
Domestic Evaporators
Bottle Cooling Coils
Commercial Ice Cube Makers

1934 KRAMER REFRIGERATION Products Literature NOW READY.

Ask for it to-day.

TRENTON AUTO RADIATOR WORKS

Main Offices and Factory, Trenton, New Jersey

NEW YORK, 241 West 68th St. **PITTSBURGH, 5145 Liberty Ave.**

Now Ready

A Great Book

Now Even GREATER

FOURTH EDITION *by* H. B. HULL

HOUSEHOLD REFRIGERATION

The Only Book of Its Kind Published

ENTIRELY REVISED—200 PAGES ADDED

MORE VALUABLE THAN EVER

THE Fourth Edition of HOUSEHOLD REFRIGERATION will be ready for distribution shortly. It contains up-to-the-minute information on new developments in household refrigeration, current up to the time of going to press. It is a book of 700 pages—200 additional pages over the previous edition.

It is the only book published on this important subject today, covering in detail the principles, types, construction and operation of both ice and mechanically cooled domestic refrigerators. During the past six years, changes of tremendous importance have occurred in the design, construction and operation of household refrigerating units. New designs, new refrigerants, new principles have been adopted. All are contained in this new Fourth Edition. It is an invaluable book for designers, manufacturers, dealers and distributors of mechanically cooled refrigerators.

700 PAGES

270 ILLUSTRATIONS

CLOTH BINDING

—

MOROCCO $5.00

$4.00 Post Paid

Published by

NICKERSON & COLLINS COMPANY

435 N. Waller Ave.

CHICAGO, ILL.

FOR YOUR CONVENIENCE USE THIS ORDER

NICKERSON & COLLINS COMPANY, PUBLISHERS, 435 N. Waller Avenue, Chicago, Ill.

Please send to the address below, a copy of the Fourth Edition of HOUSEHOLD REFRIGERATION, bound in.....
(Indicate Cloth or Morocco).

☐ Enclosed is remittance. ☐ Send Bill.

Name .....

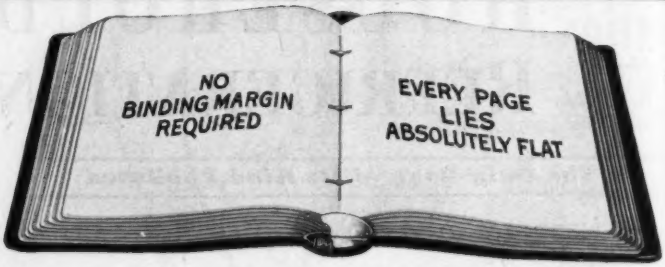
Address .....

City..... State.....

CLOTH BINDING $4.00 MOROCCO $5.00

BIND—your copies of
THE REFRIGERATION SERVICE ENGINEER
for Future Reference

ALL COPIES ARE PUNCHED TO FIT THIS BINDER



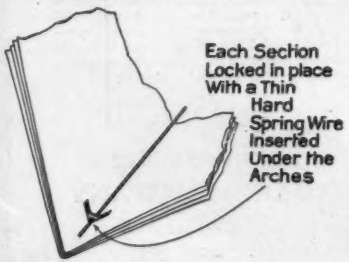
Every issue of this magazine will have valuable information which you will want to retain for future reference.

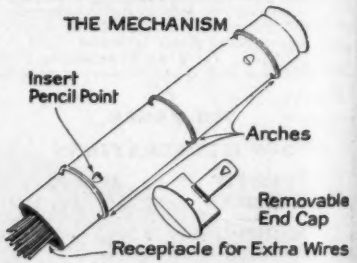
Here is a handy, substantial binder that permits you to add each copy readily as it is received. The binder is so constructed that regardless of the number of issues, every page lies flat and is easily read.

Holds twelve issues—an entire year's supply. No hunting around for lost or missing issues. The entire year's edition is always handy.

The name of the magazine is attractively stamped on the front cover in gold.

Only $1.00 postpaid





It's simple — here is how it works

Each issue is locked in place with spring wire. It takes only an instant to add an issue. Reserve supply of extra wires for future issues is kept in the back-bone of the binder. File your copies promptly as received.

Send Your Remittance of $1.00 to

THE REFRIGERATION SERVICE ENGINEER
433 NORTH WALLER AVE. CHICAGO, ILL.

The REFRIGERATION SERVICE ENGINEER

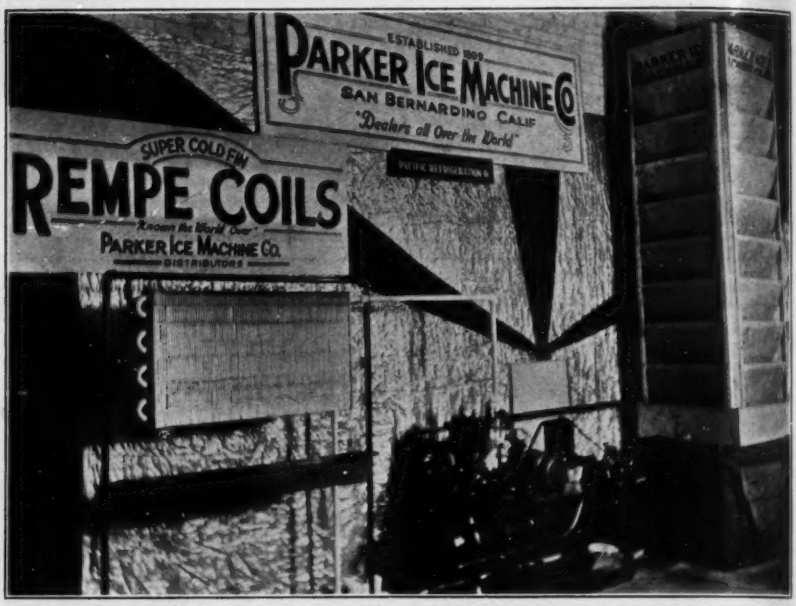
Devoted to the Servicing of
REFRIGERATION UNITS *and* OIL BURNERS

VOL. 2 MAY, 1934 NO. 5

Table of Contents

Air Conditioning—What Is It? *by Andre Merle* 5
Fractional Horsepower Motors for Refrigerators, *by R. Ehrenfeld* 9
Control of Refrigerants, *by J. L. Shrode* 12
Restaurant Refrigeration and Comfort Cooling Installation, *by John Ellison* 15
Milk Cooling 18
Complaint Chart No. 12 20
Questions and Answers 21
Editorials 22
Compressor Reconditioning Tools 23
Manufacturers' News 26
Refrigeration Service Engineers' Society News 28

PUBLISHED MONTHLY BY
NICKERSON & COLLINS COMPANY
433-435 NORTH WALLER AVE., CHICAGO, ILL.
EASTERN OFFICE: 149 BROADWAY, NEW YORK CITY
Publishers for 42 years of Technical Books and Trade Journals Serving the Refrigeration Industries.
Subscription: United States $2.00 per year. Single copies 25c. All other countries $3.00 per year.
Copyright, 1934, by Nickerson & Collins Co., Chicago



DU PONT

Artic

REG. U. S. PAT. OFF.

(DU PONT METHYL CHLORIDE)

Strict production control and analytical tests on ARTIC before shipping assure you of receiving a product *always* low in moisture and acidity, high in purity.

Adequate stocks of ARTIC are carried by distributors strategically located throughout the country, assuring prompt filling of orders. An ARTIC distributor is located near you.

Our experience of many years in manufacturing and handling ARTIC is summarized in a booklet for service men containing information on handling, servicing, testing for leaks, and other items of interest. Send for your free copy.

R&H Chemicals

THE R. & H. CHEMICALS DEPT.

E. I. DU PONT DE NEMOURS & COMPANY, INC.

Wilmington, Delaware

District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

The Refrigeration Service Engineer

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

VOL. 2, NO. 5 CHICAGO, MAY, 1934 $2.00 per Annum

Air Conditioning—What Is It?

Ever Since the Black Hole of Calcutta Shocked the World Into Vivid Realization of What Good Air Means to Living Creatures, Man Has Striven for Mechanical Processes to Control Climate Indoors Through Regulation of Temperature, Humidity, Air-Motion and Air Purity.

By ANDRE MERLE*

AIR Conditioning can be defined as a mechanical process, which enables man to control climate indoors. This is accomplished through the automatic regulation of four factors, Temperature, Humidity, Air Motion and Air Purity. American engineers are the pioneers and leaders of this modern art or science. The basis of the art is *air*, which is necessary to sustain life. We, cannot live very long without it. Air, therefore, is a very essential and vital substance. It forms part of our earth and atmosphere.

Technically, we can describe air as a gaseous mixture. Approximately twenty-one (21) parts Oxygen, a most active element. Seventy-eight (78) parts Nitrogen, which appears to dilute the oxygen. The balance of the mixture consists of water vapor and other gasses, chief of which are—Carbon Dioxide, Argon, Neon, Helium and traces of Ozone. Dust, some forms of bacteria and odors are also ever present. This briefly classifies the entire gaseous mixture which we term *air*.

Most of you, no doubt, remember reading in history, of the terrible catastrophe which occurred in a dungeon at Fort Williams, Calcutta, India. We refer to this dungeon as the "Black Hole of Calcutta." It was here, during the summer of 1758, that the most infamous disaster, caused by lack of proper ventilation occurred. According to history, 146 men were imprisoned in a space which measured about 18 x 25 feet. The men were locked in the dungeon in the early evening. Less than ten hours later 123 of them had perished from suffocation. Here, then, was our first example of the importance of proper ventilation. A copious supply of fresh air would have averted this calamity.

Better to appreciate the value of fresh air, let us review the following facts. In the course of twenty-four hours, we breathe on an average from 30 to 34 pounds of air. This is equivalent to sixteen cubic feet per hour, a quarter of a cubic foot per minute.

* Air Conditioning Engineer and Designer, has long been associated with the Carrier Engineering Corporation, where he received his early training. At present, he is engaged on the staff of Clyde R. Place, eminent Consulting Engineers, as an Air Conditioning Engineer and Designer, on the huge Rockefeller Center Development. Mr. Merle is a regular contributor to leading Heating, Ventilating, Refrigeration and Air Conditioning Magazines.

We inhale about sixteen times a minute, and draw into our lungs an average of thirty cubic inches of air at each breath. The air which enters our lungs gives up a part of its oxygen, which passes through our delicate cell walls and enters the blood. Exhaled air contains about seventeen parts oxygen (a loss of 4 parts) and CO_2 gas (carbon dioxide), which we generated during the process of food oxidization and tissue building.

Fundamentals of Climate

The most important factor of air conditioning, therefore, is *"air"*, our atmosphere. Next in importance is the condition of our atmosphere or air. We cannot control or regulate conditions out of doors, but we can and do control climate indoors. Bear in mind that the average individual spends by far the greatest portion of his time indoors. Usually we work, eight hours per day, indoors. Two more hours are spent travelling in a train or subway, indoors. Allow, say, eight hours for sleeping, indoors. The remaining six hours are for pleasure and as a general rule, we spend them indoors. Thus, three quarters of our life is spent indoors. Is there any wonder that the subject of air conditioning which permits the control of indoor climate is receiving such nationwide attention?

What then, are the proper air conditions to maintain indoors for health and comfort? This question can best be answered by a study of what constitutes "Ideal Climate." Imagine, if you will, living conditions as they exist in the frigid zones. Here, we find a rigorous cold climate. Soil that is non-productive and a sparsely populated country. Its people are very rugged, but, due to the severeness of the climate, they are not progressive. Climate in the torrid zone, on the other hand, is just the opposite—warm and humid. The soil is rich in vegetation, life and its necessities are comparatively easy to obtain. But, due to the excessive heat, one's energy, vitality and efficiency are quickly reduced. Conditions in the temperate zones are invigorating, neither excessively cold nor warm, dry or humid. We enjoy the healthful, variation or rotation of climate during the various seasons. The nerve racking monotony of constant cold or warmth, rain, snow and aridness are not present. Such a climate is both comfortable and healthful, and as a result the world's most progressive people inhabit our temperate zones. The people are active, alive, industrious and healthy. They are progressive, efficient producers and their industries are both large and varied.

Here, then, is a model climate; why not produce it indoors? Naturally, every day out of doors may not be perfect; it may be too wet, or too dry perhaps for certain manufactures. Then again it may be too warm or cold. Our climate varies. It possesses its rainy season, as well as its dry, cold or warm, and its stormy, windy seasons as well. If we could but produce at will the ideal, invigorating, healthy, delightful climate which exists during certain periods of the spring or fall without its inclement peroids we would then have the formula of ideal climate, so necessary for our health and comfort. It would have to possess four essential factors:

1—Exact Temperature. Not too warm or cold.

2—Regulated Humidity. Not too wet or dry.

3—Correct Air Motion and Distribution. Not too drafty or windy.

4—Clean, Pure, Fresh, Healthy Air, free from dust and bacteria.

Consider well these four factors of ideal climate, as they represent the basic fundamentals of *Complete Air Conditioning—temperature, humidity, air motion, purity.*

Technical Terms Applied to Air Conditioning

Better to understand the subject of air conditioning, let us review some of its more important technical terms. We should be fully conversant with them:

HEAT is a form of energy. Every substance on earth contains some degree of heat. It flows from one position to another, and upon its flow is dependent the degree of pressure or temperature differential.

DRY BULB TEMPERATURE is the tempera-

ture of the air as measured by an ordinary thermometer.

Wet Bulb Temperature is a measure of its degree of moisture. It is the temperature of evaporation. We speak of it as the second temperature of air, a most important one incidentally, in air conditioning.

Dew Point Temperature is the temperature at which air becomes saturated with moisture. When air reaches this point of temperature it contains all the moisture it can hold.

Humidity refers to the water vapor which is in the air. When air has all the water vapor (humidity) or moisture it can hold, we speak of it as being fully saturated. Bear in mind, that the absolute weight or amount of moisture varies with the temperature of the air. At say 80 degrees one pound of fully saturated air contains 155 grains of moisture. While at 60 degrees it contains but 77 grains. Remember that the humidity present in air is usually in vapor or gaseous form. It is only changed into water when the temperature of the mixture is brought below its dew point.

Relative Humidity expresses the percentage of saturation at a given temperature. Air at 50% relative humidity contains but one-half of the water vapor (moisture or humidity) it is capable of supporting at a given temperature.

Sensible Heat is the heat of the air at dry bulb temperature. Technically the sensible or specific heat of dry air at constant pressure is .241 B.t.u.'s. It may be well to state at this point that the air capacity of dehumidifiers is based on the sensible heat load. This is logical when we consider that the air entering the room does not in itself dehumidify the conditioned air but averages the room temperature and its humidity by mixing.

Latent Heat is the heat required to transform liquids to a vapor and/or vapor to liquids.

Latent Heat of Vaporization is the heat required to change a liquid to a vapor. It requires 970.4 B.t.u.'s to change water to steam at 212 degrees. We utilize this heat in winter humidification.

Latent Heat of Condensation represents the heat extracted when we change a vapor to a liquid. It requires the extraction of about 1060 B.t.u.'s to condense the moisture from the air we exhale. In air conditioning we term this process dehumidification.

Total Heat is the sum of both the sensible and latent heats. The wet bulb temperature of the air indicates its total heat, and it is an exact measure of the heat of both the air and moisture (water vapor). The latter has three components: heat of the liquid, heat of vaporization, and superheat.

Effective Temperature is an experimentally determined temperature. A true measure of our comfort as produced by the correct combination of dry and wet bulb temperatures, relative humidity and air motion.

Entering Temperature—*differential or spread,* indicates the difference in temperature between the room air and the entering conditioned air. This difference is usually in direct proportion to the height of the room. A word of caution—don't attempt temperature spreads greater than say 16 degrees, to produce comfortably, 80 degree room temperature.

Air Distribution means the method of introducing conditioned air into an enclosure. The air is usually introduced through grilles located in the side wall close to the ceiling or pan diffusers which extend through the ceiling. Return or exhaust air can be removed through grilles placed in the side wall usually near the floor.

Differential Control designates a system of automatic temperature control. It permits the inside temperature to be balanced and varied with the outside temperature. Normally, a maximum range of 15 degrees is maintained. When the outside temperature is 95 degrees, the inside could be set at 80 degrees. And as the outside temperature drops, the inside temperature would also be reduced proportionately to say 72 degrees minimum.

How Is Air Conditioning Accomplished?

The production, regulation and control of indoor climate was made possible through

the application of special mechanical equipment. Let us start with the first of the four fundamentals which this equipment should produce and maintain: *Temperature.* Some form of interchanger is required to produce this. A warm surface for heating and a chilled surface for cooling and dehumidifying. Our supply of air could thus be heated, cooled or dehumidified. Next, we would require some form of *Humidifier* for the winter humidification. *Air Filters* of some form would also be necessary to clean and purify the air. A fan would be required to draw (or blow through) the raw fresh air through our air conditioner, and *distribute* this air as well.

In the process of dehumidification in which we are most interested, we reduce a given quantity of air to a fixed dew point. By this expedient, we control and regulate its absolute humidity, by condensing the excess water vapor or moisture. As the temperature of the air is now relatively low, it must be reheated. Mixing with warm room air will accomplish this. For example, assume we dehumidify 100 cubic feet of air to a dew point of 50 degrees. Then mix say 100 cubic feet of 80 degree room air with this 50 degree air. The result is a total of 200 cubic feet of air, approximately 65 degrees in temperature. This gives us a spread of 15 degrees (80 degrees—65 degrees) which would normally be satisfactory for conditioning. *Mixing dehumidified air with reused or heated air is the basic method employed in most air conditioners.* We speak of that portion of air used to temper or reheat the dehumidified air as By-passed air. Incidentally, it forms the basic claims of the so-called by-pass patents, one of the principal methods employed for tempering conditioned air. Proper mixing of air as outlined above is the basic process employed in modern air conditioning.

In general, there are four distinct methods of producing effective cooling.

A—Lower the dew point, which reduces the moisture content.

B—Lower the dry bulb, which extracts the sensible heat.

C—Increase the air motion. This is reasonably effective.

D—Increase the wet bulb or moisture content. (This can only be effective when we have very dry, high temperature air.)

In general, we employ systems of conditioning which lower the dew point and automatically reduce the dry bulb temperature. And, as explained previously, we then mix a portion of this dehumidified air (dew point air) with the warm reused air. Complete, practical, economical air conditioning results. The other arrangements do not control or produce simultaneously all four factors of *temperature, humidity, air motion* and *air purity.* They are but makeshift systems. *Equipment which does not provide the above four features, should not be considered as complete Air Conditioners.*

Air conditioned equipment can be classified or divided into two general systems: Central Station Systems or Unit Systems. In central station systems, the air conditioning and refrigerating apparatus is usually located at a central position and the conditioned air conveyed through galvanized iron ducts to the desired spaces. Unit systems, on the other hand, are located within or adjacent to the conditioned space. Some of the units, known as Self Contained Units, have the air circulating equipment and refrigerating compressors built within the same housing. Other styles of units locate the refrigerating compressor separately, and pipe the refrigerant to the units in much the same manner as that employed in central station assemblies. Each of these systems may employ any one of three standard types of dehumidifiers.

A—Spray type (air washer or dehumidifier).

B—Surface type (cooling coils).

C—Combination type. (An assembly of both spray and surface type.)

The spray type dehumidifier employs a number of nozzles which distribute the water in a very fine spray or mist. Air to be conditioned is drawn through this spray and chilled to the proper dew point temperature. In other words, the result is somewhat simi-

lar to that produced during a heavy rain storm. If the rain is cold, the air is cooled, and if the rain is warm, the air in turn is warm. Dehumidified when chilled, and humidified when warmed.

As we pointed out before, when we pass air through a spray of chilled water, we dehumidify or condense the excess water vapor which it possessed. This process is employed in the spray type dehumidifiers. Chilled water, brine or direct expansion of a refrigerant are utilized in surface type dehumidifiers. The cooling medium is passed through the coils, in much the same manner as a heating medium. The chilled water or brine is quite similar in operation to a hot water heating system. Direct expansion can be pictured as similar to steam vapor. Refrigerating vapor produces the cooling effect in much the same manner as steam produces heating. Combination spray and surface dehumidifiers, utilize both spray and surface cooling. Any one of these systems are practical and efficient.

Refrigeration Systems

In order to thoroughly dehumidify air, we usually employ some form of refrigeration. It may be well to point out that the use of very low temperatures are not required for the dehumidification and cooling of air. Relatively high temperature refrigerating capable of producing water temperatures between 40 to 60 degrees is sufficient. Refrigerating machines designed for below zero temperatures or ice making are *out*. There is no need or demand for such expensive equipment.

Fractional Horsepower Motors For Refrigerators

Advancement of Small Motor Design. Operation of Split Phase and Repulsion Start-Induction Motors. Speed Torque Characteristics Illustrated by Diagrams.

By R. EHRENFELD*

FROM year to year as the application of small motors has advanced and the performance requirements have changed, new types of motors have been developed by the motor manufacturers. Because of the fact that only single phase power is ordinarily available where fractional horsepower motors are to be operated, various schemes have been devised for starting single phase induction motors in order that they may have the required starting torque and pull-in torque. If power is applied to one phase of a polyphase motor the motor will not develop a starting torque due to the fact that a rotating field is not produced as is the case when all phases of the motor are connected to the source of power. This lack of rotating field in a single phase motor makes it necessary to artificially produce a rotating field during the starting period, or develop a type of motor which during its starting period is not an induction motor. Split phase motors and capacitor motors followed in the first class and repulsion start induction motors are the latter class. In the split phase motors, capacitor start motors, and repulsion start induction motors the running conditions are identical. A single main winding is connected to the line and the rotating field is produced by a combination of the current in the stator and induced currents in the rotor. Capacitor motors, which have their auxiliary winding energized during normal running, are similar in performance to polyphase motors.

Split Phase Motors

This type of motor was the first to be developed as a small constant speed A.C. motor. With the rotor at standstill and the

* Manager, Small Motor Engineering Department
Westinghouse Electric & Manufacturing Company

main or running winding connected to the line, there is no tendency for the motor to start. This is indicated by Curve "A" Fig. 1. An auxiliary winding is associated with the main winding both as to the mechanical location and electrical characteristics so that

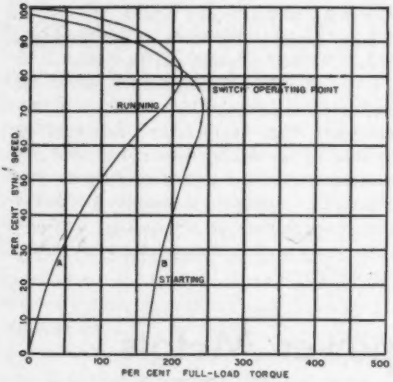


FIG. 1. SPLIT-PHASE MOTOR SPEED TORQUE CURVE

when the two windings are connected to the same source of single phase power a rotating field is produced in the motor. This is an imperfect rotating field as compared with a polyphase motor and for that reason much more starting current is required to obtain a given starting torque than is required for a polyphase motor. In such a motor the auxiliary winding is usually made of fine wire in order to get the proper electrical characteristics. This winding cannot be permitted to be connected to the line for an appreciable length of time as it will quickly burn out. The speed torque characteristics of these combined windings are shown by Curve "B", Fig. 1. A switch is connected in the starting winding circuit so that at a predetermined speed the starting winding is opened and the motor continues to run with a speed torque curve as indicated by "A".

Repulsion Start Induction Motors

As stated before the speed torque characteristic of this motor with its running connection is the same as that of the split phase motor. Such a curve is indicated as "C", Fig. 2, which is practically identical to Curve "A". However, in the case of the repulsion start induction motor an entirely different principle is used to obtain the necessary starting torque and the pull-in torque to get the motor up to speed.

There is but one winding on the stator, which corresponds to the main winding in the split phase motor. While the rotor of the split phase motor is squirrel cage, the rotor of the repulsion start induction motor has a winding connected to a commutator and is in every way quite similar to a D.C. motor armature. Both during starting and during running power is supplied to the stator winding only. During the starting period current is induced in the armature winding and flows from the commutator through the connection which short circuits the two brushes. These brushes are so located that the magnetic field produced by the rotor current and the interaction of the armature current and main field produce a strong force tending to rotate the armature. This type of motor is very effective from the standpoint of producing a high starting torque with a relatively low starting current.

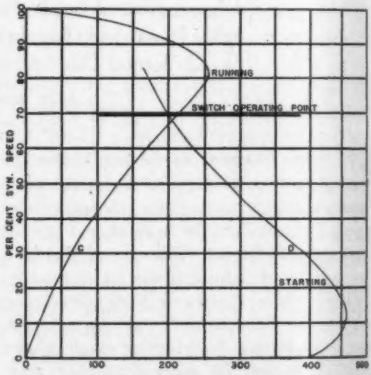


FIG. 2. REPULSION START-INDUCTION RUN MOTOR SPEED TORQUE CURVES

While the motor is connected for this condition, it has a varying speed torque characteristic; that is, its speed changes materially with changes in load. This makes it necessary to change the connections in the motor so that under normal running conditions it becomes an induction motor of the usual type. This change in connection is

obtained by short-circuiting the commutator at a predetermined speed as indicated on Curves "C" and "D", Fig. 2. When the commutator is short-circuited the rotor winding is then equivalent to the squirrel cage winding in the split phase motor.

There is another type of motor known as repulsion induction motor, which has a single speed torque curve which might be considered as a combination of Curves "C" and "D". In addition to the winding on the rotor, which is connected to the commutator, there is an additional squirrel cage winding underneath the wire winding. The commutator is not short-circuited during running and current is carried in the brushes continuously. This type of motor has a varying speed torque characteristic, but the change in speed for change in load is not nearly so great as indicated by Curve "D". This type of motor as compared with repulsion start motor is more simple mechanically because of the omission of the commutator short-circuiter, but it has a disadvantage of having current flowing continuously in the brushes.

The Service Shop

A Good Shop Is An Incentive for Better Work. Well Lighted and Well Ventilated Shop Should Be Selected

IT is generally convenient in the majority of service calls to effect repairs without removing the unit from the premises of the owner. Sometimes, and after a certain amount of service, it will be necessary to take part or the entire unit to the service shop so that, working under the best conditions with good light, proper tools and equipment, the unit or part may be properly overhauled.

A well-lighted shop is an incentive to do good work. Many small establishments have begun in a garage; one of the double-car type supplying ample room to store parts, provide working and overhauling space and permit easy entry and removal of units or entire cabinets.

A two-car garage usually measures about eighteen feet square, and this size will be found quite sufficient for a two man service crew. It is best to have as many windows and skylights as possible; for sometimes a unit will develop an uncontrollable leak while undergoing repairs or in testing. With methyl chloride, ethyl chloride, Isobutane, and of course with air and carbon dioxide units, a discharge of the refrigerant into workshop atmosphere will cause no discomfort; but with sulphur dioxide and ammonia, not only will the air be rendered irritating but unbearable if sufficient is released to approach that of poisonous mixtures.

Therefore, provide means of securing proper ventilation. Daylight is the best form of illumination; and as an aid on dark days, and in the event that night work must be indulged in, provide plenty of electric bulbs and sockets for portable light. Do not forget that the units must be tested, so leave three or four electric outlets for that purpose.

Gas is convenient for heating and drying parts, and is especially useful on damp days, when the atmosphere is supercharged with moisture. In some sections of the country, electric rates are such that electric heaters may be used. Open flames at all times are hazardous things, and especially with ethyl chloride, methyl chloride and Isobutane vapors. Several pails of sand should be hung up, for use on oil or electric fires, while at least two fire extinguishers should be available for use on fires of general sorts.

An all-round service shop must be equipped with a twenty- or fifty-pound drum of each refrigerant; the first size tank for methyl chloride, ethyl chloride, sulphur dioxide, carbon dioxide and Isobutane; and the larger size for ammonia.

Two or more small service drums, holding from three to five pounds of refrigerant should be carried for each refrigerant stocked. Be sure that the drums are made in accordance with the I. C. C. regulations.

The Control of Refrigerants . . .

ARTICLE NO. 9 THE THERMOSTATIC EXPANSION VALVE

Installation of Thermostatic Valves. Control of Compressor. Combination "Hook-Ups". Controlling Flow of Refrigerant. Magnetic Liquid Stop Valves. Locating Valves.

By J. L. SHRODE *

FIGURE 1 shows the proper installation of the thermostatic valve. The valve body is always installed in the liquid line as near as possible to the evaporator. It may be located inside or outside of the cold room. Where the temperature of the room is below 20° F. it is best to install the valve outside. There must be no restrictions between the thermostatic valve and the evaporator such as hand expansion valves. The reasons for this precaution have been given in the chapter on the constant pressure type expansion valve. A good liquid filter should be installed directly ahead of this valve.

The bulb should be fastened to the suction line as close as possible to the evaporator and inside the cooler. It is important that the bulb make a good contact with the pipe. For this reason the pipe should be cleaned

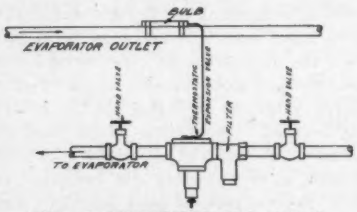


FIG. 1. THERMOSTATIC VALVE INSTALLATION.

thoroughly with emery paper or a file and painted with ordinary aluminum radiator paint before mounting the bulb. The bulb is then placed on the pipe and is held in place by suitable clamps. On vertical lines the bulb should be placed with the tubing at the top; on horizontal lines the bulb should be placed on the side of the pipe with the tubing toward the top. If the bulb is located higher than the valve body the tubing must loop upward from the bulb a distance of 6 to 12 inches to form a trap. If the bulb is lower than the valve this is not necessary.

It is very important that the thermostat bulb be installed inside of the unit being refrigerated, whether it be a room cooler, counter, water tank, or brine tank. In the case of the last two mentioned, the bulb should be placed on the outside of the pipe below the liquid surface. If the bulb is located outside of the unit being cooled and in a warmer area it is readily seen that the valve will remain open longer than it should and will not close off during the shut down period. Conversely, if the valve is located outside of the unit being cooled and in a colder area, the valve will remain closed longer than it should and will often cause the system to operate at too low a suction pressure. This will also be the case if the bulb is installed outside of the unit and is heavily insulated. The bulb should always be located in the same temperature area as the evaporator coils so that the valve will be operated entirely by the superheat of the suction gas. When a magnetic liquid stop valve is used in connection with a thermostatic expansion valve, the bulb may be installed outside of the unit being cooled since the magnetic valve closes the liquid line during the shut down period. In this case it is necessary to install the bulb in the suction line under the cork covering.

The thermostatic valve, as has been previously pointed out, may be on any style or type of evaporator. It may be applied equally well on pipe coils, finned type coils, or unit coolers.

The most extensive application for the thermostatic expansion valves is on installations where several evaporator coils are operated on one compressor. It is very difficult to obtain close temperature control

* President, Alco Valve Co., St. Louis, Mo.

in the individual units if the coils are all in series. Quite often the load and service requirements change after the coils are installed and in attempting to regulate the refrigerant feed to improve the conditions in one unit, the temperature conditions in the other units are affected. If the units are connected in multiple and a thermostatic expansion valve is installed in the liquid line to each unit the valves may be adjusted independently to maintain the desired conditions in each room. The ability of this valve to reduce the effective portion of the evaporator and thus balance the load properly between two or more evaporating units in parallel on one compressor makes it a very suitable control for multi-unit systems.

The compressor may be controlled either by thermostats or by a single suction pressure switch. If there is but one evaporator on the system a closer control is obtained by using a thermostat. On a multi-unit installation, one thermostat placed in the most important room may be used to start and stop the compressor. If the temperature of more than one unit is important, two or more thermostats wired in parallel may be used.

Another method of operating the compressor is the use of the suction pressure switch installed in the main suction line. When the suction pressure reaches a predetermined point, the compressor is automatically started and when the pressure drops to the lower limit, the compressor stops. The suction pressure switch operates as a huge thermostat which starts and stops the compressor according to the average of the temperatures in all the units. This type of control is of greatest value in plants where the coolers are approximately the same size and temperature and where the loads vary considerably.

Magnetic stop valves ahead of the thermostatic expansion valves or at the evaporator outlets are generally unnecessary. If the remote bulbs are installed inside the cold rooms, if the temperature split between the refrigerant and the medium to be cooled is at least 15° F., and if the suction gas is superheated at least 5° the valve will close tightly when the compressor is shut down. Fairly close temperatures can be held in the units under these conditions.

If extremely close temperatures are re-

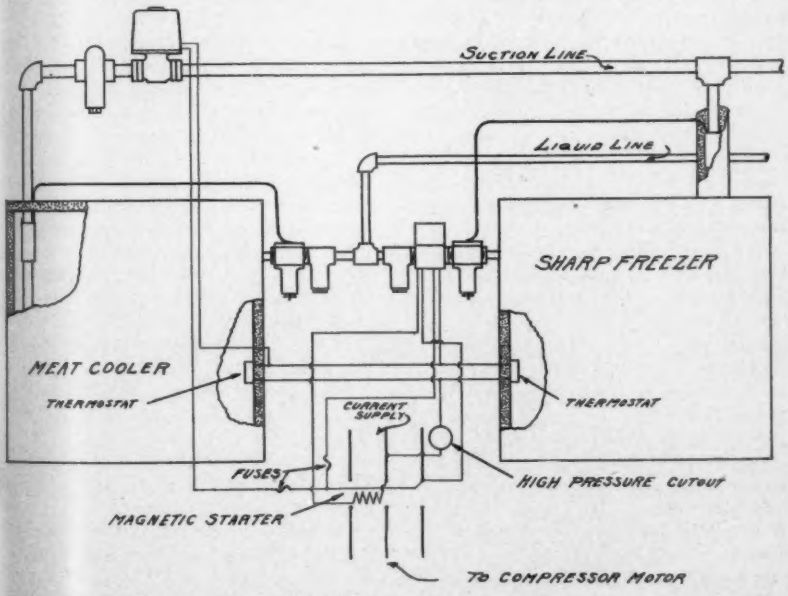


FIG. 2. TYPICAL VALVE INSTALLATION.

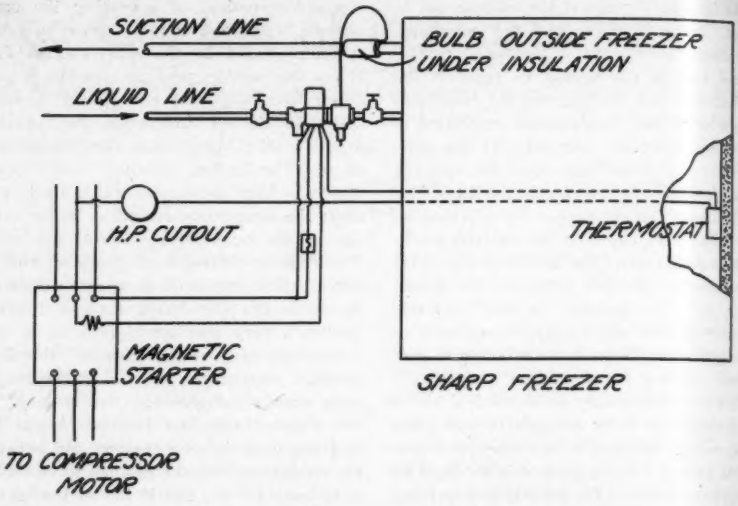


FIG. 3. VALVE INSTALLATION ON SHARP FREEZER

quired or if the above conditions cannot be fulfilled, magnetic liquid stop valves must be installed ahead of the thermostatic expansion valves. A thermostat located in each unit operates a magnetic valve feeding that unit. Then, whenever any unit comes down to a predetermined low temperature, the thermostat in that unit closes its magnetic liquid stop valve and the flow of the refrigerant is stopped. When the temperature of the unit becomes too high the thermostat opens the magnetic valve and refrigeration again takes place.

The sharp freezer illustrated in Figure 2 is an example of such a condition as described above. The product in this freezer is to be held at 10° F. with as little differential as possible. A 10° temperature difference between the refrigerant and the room is to be maintained. Since the temperature difference between the refrigerant and the room is below 15° F. and, therefore, the amount of superheat in the suction gas is low, the thermostatic expansion valve will not shut off tightly during the shut down periods. A magnetic liquid stop valve and a thermostat are used on this installation to maintain a close temperature and to prevent the coils from filling up with liquor during the shut down periods. In this case, where a magnetic valve is used, the bulb may be located outside the freezer as shown but must be insulated.

If a temperature difference of more than 20° to 25° F. is required between two or more units fed in parallel from one compressor, magnetic suction line stop valves should be installed in the evaporator outlets of the higher temperature rooms. When these units come down to temperature, their thermostats close the magnetic suction valves, thus stopping refrigeration in the units. The compressor will then work on only the low temperature units. The suction line stop valve prevents the refrigerant in the high temperature coils from condensing in the low temperature coils during the shut down periods.

Suppose that a meat cooler is connected in parallel with the freezer discussed above. The cooler is to be held at 36° to 38° F. and the freezer at 10° F. They are connected in parallel to the same compressor. Figure 3 shows this installation. Thermostats and a magnetic liquid stop valve, in addition to the thermostatic expansion valves, are installed on both units to maintain the desired temperatures and to stop the flow

of the refrigerant during the shut down periods. A magnetic suction line stop valve is installed in the cooler evaporator outlet and when that unit reaches the desired temperature, its thermostat closes the suction line valve. If the suction line valve were not used, the refrigerant in the 38° cooler would condense in the 10° freezer during the shut down periods and cause additional refrigeration in the warmer room. The cooler would then become too cold every time the compressor shuts down. Then, too, if the cooler were larger than the freezer, enough liquor might condense in the freezer coils to cause the compressor to pump liquor when it started up again.

When a thermostatic expansion valve is used to control the flow of refrigerant to a brine tank, the liquid supply should be stopped during the shut down periods either by a hand valve or a magnetic liquid valve. The temperature difference between the refrigerant and the brine is generally less than 15° and since the brine temperatures usually carried are such that the superheat in the suction gas never exceeds 15°, the thermostatic expansion valve will not close tightly during the shut down periods. The expansion valve, however, does provide automatic feed of the refrigerant during operation which is a decided advantage even on hand operated brine systems. The installation shown in Figure 4 is a manually operated system employing a thermostatic expansion valve to regulate the flow of the refrigerant to the brine tank. Before the installation of the automatic expansion valve, a hand expansion valve was used and the operator experienced considerable difficulty in setting the hand valve properly. Either liquor was drawn back to the compressor or the superheat was so high that the operating time of the compressor was increased. The thermostatic expansion valve corrected this situation. The hand stop valve is closed during the shut down periods. By installing a thermostat in the brine tank and a magnetic liquid stop valve in the feed line this system may be automatically controlled.

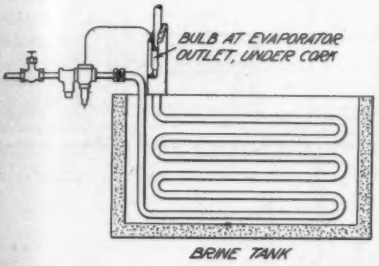


FIG. 4. MANUALLY OPERATED VALVES.

RESTAURANT REFRIGERATION AND COMFORT COOLING

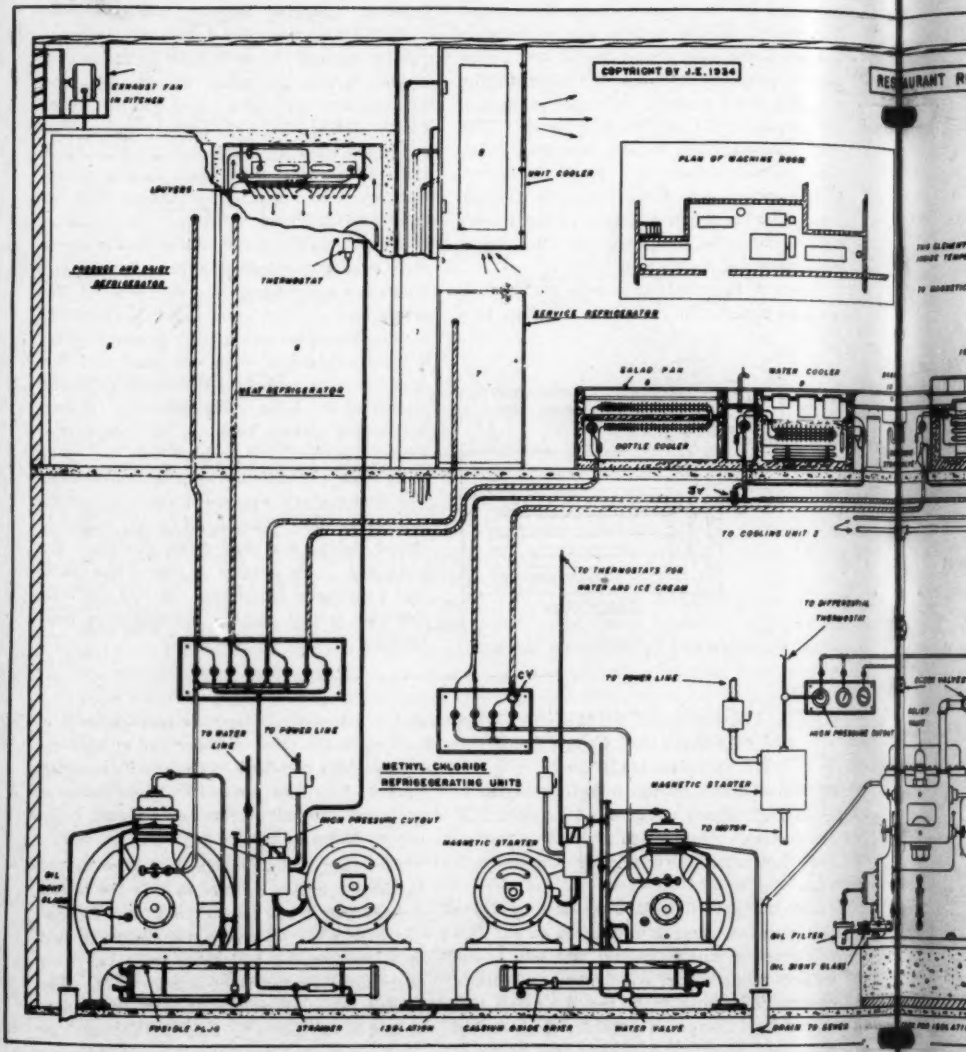
By JOHN ELLISON*

THE diagram on the following pages, 16 and 17, shows a layout of refrigerating and cooling equipment suitable for a restaurant, lunchroom, cafeteria or similar business.

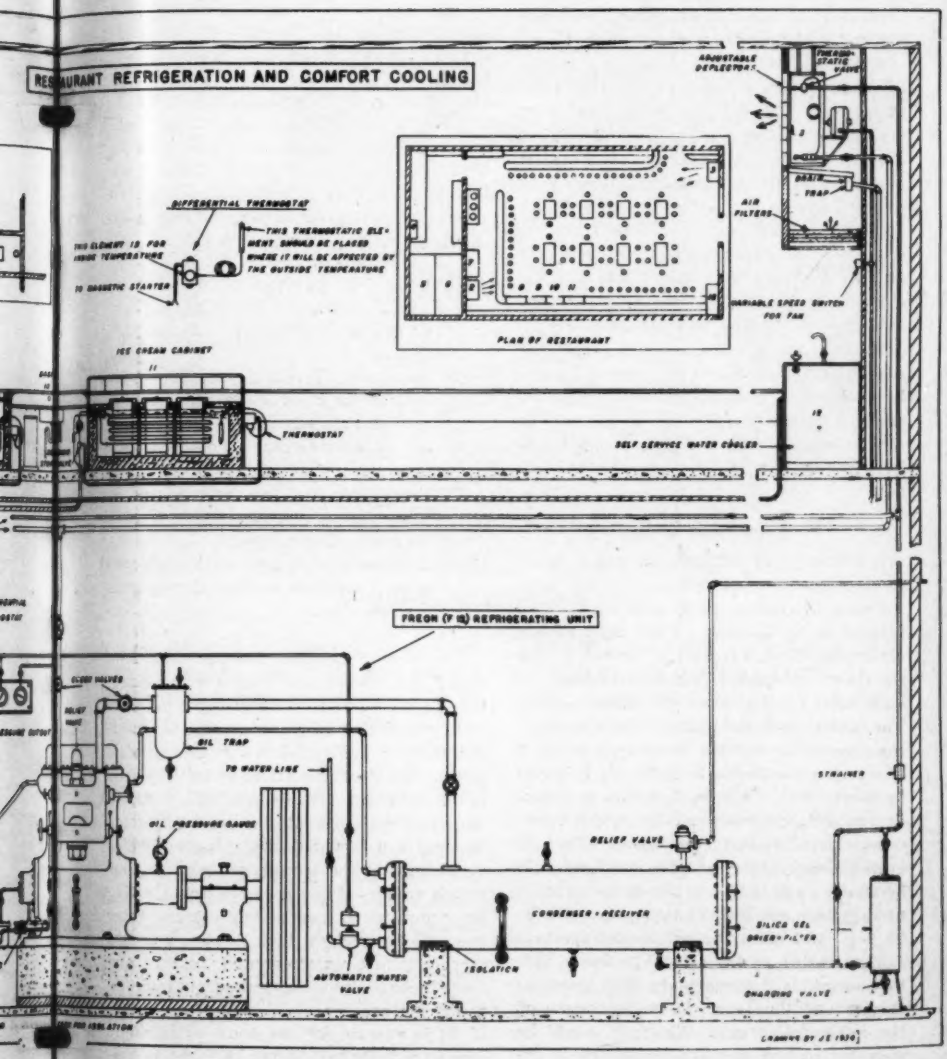
Two methyl chloride units are used for refrigeration. One is connected to the two refrigerators in the kitchen and also to the service refrigerator, salad pan and bottle cooler. The evaporator for the salad pan should be as large as possible, the pan will never get too cold. A temperature of about 38-41 deg. F. is maintained in the combination produce and dairy refrigerator, service refrigerator and bottle cooler. A thermostat which controls the refrigerating unit is located in the meat refrigerator in which a temperature of about 35-38 deg. F. is maintained. It will be noticed that louvred pans are used instead of the conventional baffle boards and drip pans.

The other methyl chloride unit is connected to the ice cream cabinet and to the water coolers. By using two thermostats the temperature of the ice cream will always be just right for serving and there will always be cool water at the right temperature. The thermostatic valves in the water coolers should be adjusted so that the temperature of the water will be approximately the same in both coolers. A check valve CV is placed in the suction line from the ice cream cabinet. This valve will prevent the higher temperature gas from the water coolers from in-

* Copyright 1934, by John Ellison.



TYPICAL LAYOUT FOR RESTAURANT AND COMFORT



RANT AND COMFORT COOLING INSTALLATION.

terfering with the lower temperature which must be maintained in the ice cream cabinet, and also prevents any of the higher temperature gas from condensing in the lower temperature ice cream coil; hence the refrigerating unit will operate more efficiently.

A solenoid stop valve is installed in the liquid line and connected in series with the thermostat. This valve closes when the thermostat cuts out and opens when it cuts in. The two thermostats should be connected in parallel, thus the refrigerating unit will keep on running as long as either the water cooler or ice cream cabinet requires refrigeration, and when the temperature of both has been reduced to the point desired the unit will stop. As soon as either one again requires refrigeration the unit will start.

In certain localities there is an ordinance requiring that the valves for the evaporators be enclosed in a metal box and the tubing must be enclosed in flexible conduit or pipe for protection. This method of installation is, however, a good practice, ordinance or not.

Freon Unit Used

A Freon (F12) refrigerating unit supplies refrigeration for the two unit coolers used for comfort cooling, these units supply cool filtered air to the room. There is no outside air intake, the infiltration of air every time the doors are opened (which will usually be quite often) will give any air change needed. The differential thermostat which controls the temperature of the room operates on a curve close to the A. S. H. & V. E.'s recommendations. That is, it maintains a predetermined temperature difference between outside and inside temperatures. Thus, if outside temperature is 95 deg. the inside will be 80 deg., and if the outside temperature is 81 deg. then the inside temperature will be 76 deg., and when the outside temperature falls to 74 deg. no cooling will be done. This thermostat is connected to the magnetic starter and thus controls the operation of the refrigerating unit. The fans should be operated continuously and should also be arranged for variable speed so as to be able to control the velocity of the air.

An exhaust fan is used to exhaust the warm air from the kitchen.

MILK COOLING

COOLING milk from body heat down to 50 degrees F. in the cans in approximately one hour is the accomplishment of a new-type cooler just brought out by Frigidaire. The new cooler is designed to place milk cooling within the reach of the average dairy farmer.

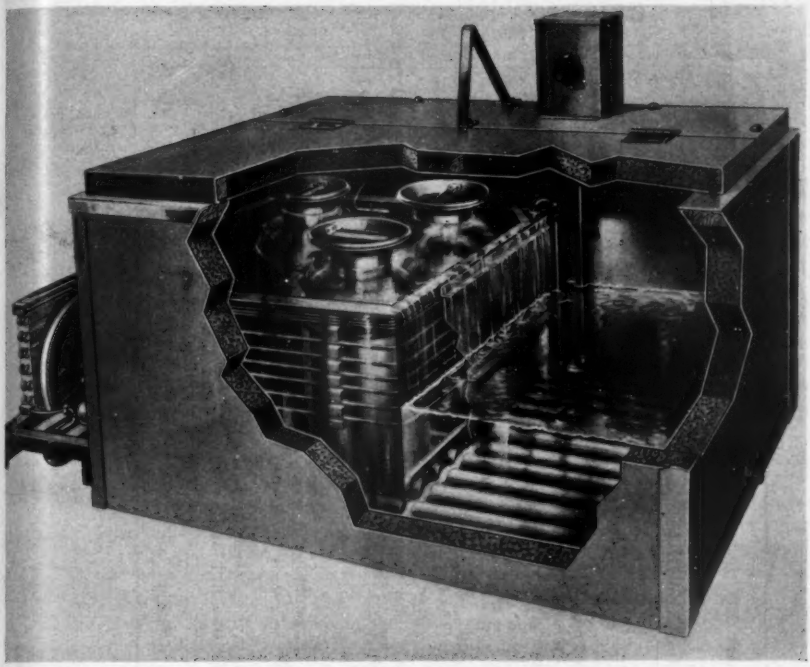
Labor is reduced to a minimum and handling made easy through elimination of the need of employing an aerator. In fact, the use of this device makes milk cooling even simpler than the old method of immersing the milk cans in a trough of water.

Features of the new cooler are:

(1) Quick cooling to 50 degrees F. as prescribed by the United States government.
(2) Automatic leveling of the water around the cans, keeping it constant around the neck of the cans regardless of whether more cans are added or whether some are removed.
(3) Saves time that can be employed in other farm operations.
(4) Economy of operation.
(5) Uniform cooling insured through constant circulation of water during cooling operation.

The new Frigidaire flowing cold milk cooler is a double tank with a water circulating system and a refrigerating coil. Constant circulation of water during the cooling time is accomplished by means of a pump. To start operation, water is placed in the main tank. As a can of milk is added, the water overflows into the secondary tank. Another can is added and still more water overflows into the secondary tank. A time switch on top of the cooler is set, starting the pump, which immediately returns water from the secondary tank to the primary, causing it to circulate around the cans and cascade back into the secondary tank all ready for another cycle. The time switch is set to operate for one hour, as carefully conducted tests have shown that in this time milk should be properly cooled from body heat down to 50 degrees F.

The water is kept cold by means of a Frigidaire compressor and the temperature



FRIGIDAIRE MILK COOLING TANK

is controlled by a thermostat. The coils are placed around the sides of the tank, while at the top they are close together so that ice quickly forms. This ice functions as a refrigerant, keeping the water cold and thus reducing the operating time of the compressor to bring economy in operating costs.

When the farmer completes his milking at night, he merely places the cans of milk in the cooler, turns on the switch, and continues on about his other chores. The switch insures operation of the pump for an hour and keeps the water continually agitated. In this hour of operation, the milk is cooled down to a temperature that insures a low bacteria count.

In the morning, after milking, the morning milk is added and the switch again thrown, thus cooling the fresh milking within an hour. The milk may be stored in the cooler until it is time to take it to market.

MANUFACTURES ACCESSORIES FOR REFRIGERATION

THE Standard Refrigeration Parts Company, 5101 W. Madison Street, Chicago, of which Harry and Herman Goldberg are the principles, has recently announced that their shop has been equipped to manufacture a line of refrigeration accessories. The company is very well known among service men and service organizations in Chicago and surrounding territory through their identity with the refrigeration industry during the past many years.

In addition to their acting as representatives for manufacturers of refrigeration supplies and gases, the new products which they will manufacture will include domestic two, three, four, five and six tray dry evaporators; water and air-cooled condensers; bare pipe coils; plate coils; ice cube makers, and sheet metal construction for all refrigeration requirements.

CHART NO. 12

SHORT RULES FOR COMMERCIAL UNITS

Capacity:—

Allow 1/10 pound I.M.E. hour refrigeration capacity per square foot outside insulation of refrigerator (above freezing).
Allow 15 B. t. u. per hour refrigeration capacity per sq. ft. exterior surface.
Allow ½ pound I.M.E. hour capacity per sq. ft. double glass.
Allow 75 B. t. u. per hour capacity per sq. ft. double glass.
Allow 2 lbs. I.M.E. hour per foot of counter.

Fin Coils:—

Allow 1/5 lb. I.M.E. hour per sq. ft. fin coil (d.e.).
Allow 30 B. t. u. per hour per sq. ft. fin coil (d.e.).
Allow ten sq. ft. fin coil per foot length of display counter.
Allow one sq. ft. fin coil surface per sq. ft. (Larkin), exterior surface of refrigerator.
Above date only approximate. Check by chart 24, 25, 15F, 15G, and Table Pr-15T, and manufacturer's coil data.

MOTOR POWER:—

Horse power of motor for SO_2 or Isobutane = Cu. In. per minute ÷ 10,000.
Horse power of motor for methyl chloride or F-12 = Cu. In. per min ÷ 8,000.
1000 cu. in. per min. = 34.8 cu. ft. per hour.
Allow one horse power per 275 cu. ft. per hour methyl chloride or F-12.
Allow one horse power per 350 cu. ft. per hour SO_2 or Isobutane.

COPYRIGHTED—HERKIMER INSTITUTE OF REFRIGERATION, N. Y.

12

Cut out along outer line and insert in binder for ready reference.

FOR LEATHER BINDER WRITE TO H. T. McDERMOTT, SECRETARY REFRIGERATION SERVICE ENGINEERS' SOCIETY
433 N. WALLER AVE., CHICAGO, ILL.

THE Question BOX

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box" which will be answered by competent authorities.

THE following questions have been referred to the Question Box and are answered by C. E. Hamilton, chairman of the Educational Committee, Chicago Chapter, Refrigeration Service Engineers' Society.

Capacity of CO_2 and F-12 Machines

Question 40. How can one tell the ton capacity of CO_2 and F-12 machines?

ANSWER. This question is too general to be answered with any degree of accuracy. The capacity of a machine will vary with the use, the operating pressures, cooling medium for the condenser, design, etc. As a general statement (rule of thumb), with a 70° F. water discharge on a 10 H.P. water-cooled machine, the capacity would be about 10 ton on an air-conditioning job and 5 ton on a refrigeration installation. Air-cooled machine, 10 H.P. motor, 5 ton on A.C.; 2½ ton on refrigeration.

Frost on Evaporator

Question 41. Is there any information relative to the effect of frost on the evaporator?

ANSWER. The coefficient of heat transfer is greatest when the surface cooling unit is in a wetted condition, with moisture only, and decreases after the moisture freezes on the cooling unit in the form of ice or snow. Frost on a cooling unit coil acts similar to wrapping a blanket around the cooling unit as it serves as an insulate. A fraction of an inch of frost may lower the efficiency of the coil as much as fifty per cent, depending somewhat upon the design of the coil and the air velocity over it.

The operating cost is increased when the cooling unit is covered with a blanket of frost. If the thermostat bulb is installed in the air of the cabinet, the running periods will be longer, due to the reduced rate of heat flow from the cabinet storage space to the cooling unit. If the thermostat bulb is attached to the cooling unit or the system is pressure controlled, short cycling will result and the operating cost will be increased.

Electrice Machine

Question 42. I was called in on an Electrice machine the other day. There are only a few in town, and although I got a little dope out of past issues of THE REFRIGERATION SERVICE ENGINEER, it is not enough.

From my diagnosis, the seal leaked letting the gas and most of the oil escape. From the sound of the compressor grinding, it must have been run with a lack of oil.

The question is, could I rebuild his condensing unit using an overhauled Servel two cylinder compressor? As I see it, the present machine has what appears to be a high pressure float with a capillary tube running up to the cast iron evaporator. Is that correct? Is it a balanced charge machine? If I replaced his compressor with a reciprocating compressor and ran the condenser outlet to the float chamber as at present, would it give efficient refrigeration with the present evaporator, or would you rebuild the whole thing using a low float or expansion valve coil?

ANSWER. The compressor of the Electrice machine referred to could be replaced with a Servel compressor if desired. However, the two-cylinder Servel compressor is designed to operate at a speed of approximately 875 R.P.M. Therefore, it is suggested that the compressor and motor be turned around so that a belt driven can be employed. The condenser should be so mounted as to allow cooling of it by the air-blast from the motor pulley. In other words, the whole condensing unit should be rearranged and remounted on another base.

A high side float is used as the refrigerant flow control in the Electrice system. You can continue to use this float, if it is in good condition, connecting it to the condenser as suggested in your letter. You also can continue to use the cooling unit now installed in the cabinet.

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 2 May, 1934 No. 5

RATES OF SUBSCRIPTION
In Advance, Postage Paid
UNITED STATES - - - - - - - - - $2.00 a year
ALL OTHER COUNTRIES - - - - $3.00 a year
Single copies, 25 cents

Advertising rates on application. Make remittances by postoffice or express money orders, international money orders, checks or drafts on Chicago or New York, payable to Nickerson & Collins Co., Publishers.

NICKERSON & COLLINS CO., *Publishers*
General Office.....433 N. Waller Ave., Chicago
Telephone Austin 1303, 1304 and 1305
Eastern Office.....149 Broadway, New York City
Telephone Barclay 7-8275

Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

"BY THEIR WORKS YE SHALL KNOW THEM"

THE advent of warm weather is always a welcome sign to the service man. Refrigeration weather is longingly looked forward to after a period of lessened activity during the winter months. This let-up is particularly pronounced in the Northern states, while in the South, the demand for refrigeration is more uniform throughout the year. However, the hot humid months with refrigeration equipment expected to operate at its maximum capacity, is always a good season for servicing because the necessity for unfailing refrigeration is more fully recognized.

Again, Spring brings the established refrigeration service man or organization (which by this time must seem to be an annual event), the problem of the itinerant service man who visualizes some quick money to be made during a period of peak demand, and then, "to pull stakes" at the first indication that the demand for refrigeration servicing is lessening.

Unfortunately, this experience is costly to the householder, not only in inefficient work and unsatisfactory refrigeration service, but the additional cost of placing the equipment again in satisfactory operating condition. The established service man or service organization can accomplish much to discourage the employment of such individuals through intelligent promotional work.

Your business next year and the years after depends greatly upon the results of the work you do this year. Word of mouth advertising is a potent force in the development of any business which supplies a service to a community. It will either make or break an organization. The qualified service man or organization while temporarily disturbed by these unethical practices, has no cause for concern of the future of his business if he serves his customers in a conscientious manner.

Be honest with the customer—correctly advise the extent and the cost of the work to be done, which will be required to place the equipment in the most satisfactory operating condition. If the customer is not willing to expend the necessary money to do a first-class job, there should be a very definite understanding between the householder and the service man as to the performance of the machine after the work is completed. If the householder, after thoroughly knowing the facts, has agreed, she is satisfied to have the equipment placed in operation no matter how temporary the repair may be, it is, of course, the duty of the service man to do this work as satisfactorily as conditions may permit.

THE FIRST MILESTONE

THIS issue of the REFRIGERATION SERVICE ENGINEER completes the first year's service to the refrigeration servicing profession.

The publishers are grateful for the reception accorded to this monthly journal and are appreciative of the many friends it has made during its first year's existence. Again we renew our pledge to further the interests of the men who have identified themselves with this growing profession. Again we solicit your constructive suggestions in the interest of improving the service of *your* journal.

The service man is a most important factor between the manufacturer and user. He not only services equipment but can be of invaluable help to the sales department.

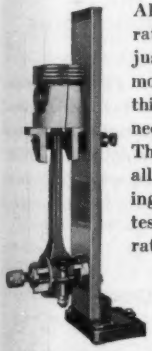
NEW MECHANICAL DEVICES
Service Tools and Special Equipment

Under this heading there will be published illustrated descriptions of new or improved service tools and equipment for the Service Engineer.

COMPRESSOR RECONDITIONING TOOLS

COMPRESSOR reconditioning must be accurately done if ultimate results are to be satisfactory. The development therefore of tools for reconditioning refrigerator compressors has been the outcome of experienced tool makers. The following is descriptive of tools manufactured by the Automotive Maintenance Machinery Co., for compressors.

Ammco Connecting Rod Aligner



CONNECTING ROD ALIGNER

The Ammco Model B Aligner consists of an accurate surface plate. An adjustable three-jaw arbor is mounted near the bottom of this plate to support connecting rods in alignment. The arbor is adjustable to all sizes of rods and no bushings are needed. A sliding test bracket with two accurately finished test surfaces can be raised or lowered to check any length of connecting rods. Special straightening tools which impose no strain whatever on the aligner are available.

Ammco Piston Ring File

The Ammco Piston Ring File, as it is called, saves thousands of steps to and from the bench on every ring-fitting job. It encourages more accurate fitting to eliminate ring distortion which causes breakage, scored cylinders, and over-heating. It handles all types and sizes of piston rings: 45° angle cut, step cut, or square cut.

The Ammco Piston Ring File consists of a bracket that clamps to a stud or cap screw in the cylinder head, or may be held in a vise. The bracket supports a v-guide plate on which the file is held and along which the ring guide moves. The bracket supports

PISTON RING FILE

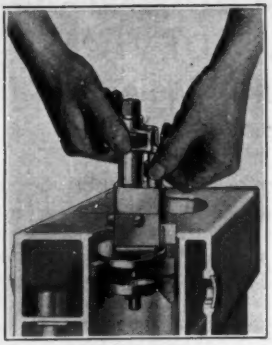
piston ring correctly for proper filing to insure perfect results. File holder is specially slotted to hold the file in three positions: vertical and 45° left or right.

In operation, the ring is held in the guide so that the joint straddles the file. Pressure of the finger tips holds the ends against the file. A few movements backwards and forwards provide the desired clearance and a clean accurate joint on any type of ring.

Ammco Ridge Reamer

The Ammco Ridge Reamer is a sturdily constructed tool that locates below the ridge where it is centered and held in the cylinder itself, so that the exact shape and contour of the cylinder bore is maintained. The blade provided with the reamer has two cutting ends to provide either straight or tapered cut. It is the only tool having a tapered blade which prevents cutting too far into one side of the cylinder while removing the ridge from the other.

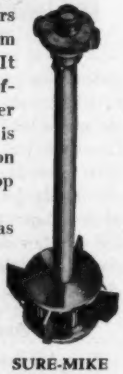
The Ammco Ridge Reamer removes ridges of any depth, provides a velvet finish, and eliminates chatter. There are only two adjustments, and any wrench operates the tool.



RIDGE REAMER

A New Cylinder Gauge

The Ammco Sure-Mike, as it is called, is in effect an expanding plug gauge, incorporating methods of checking in use in car manufacturers' production lines. It is a rigid, dependable tool that checks and measures cylinders along their entire length from extreme top to bottom. It clearly shows taper, out-of-roundness, pockets, and other irregularities. Any variation is easily read in thousandths on the adjustable dial at the top of the tool.



SURE-MIKE CYLINDER GAUGE

The Ammco Sure-Mike has two adjustments: One for setting the tool to the cylinder size; the other for setting the graduated dial to zero to measure oversize and undersize in thousandths of an inch. Individual locks are provided for each adjustment. The adjustable dial also compensates for wear, as in the case of any micrometer.

Piston Pin Hole Grinder

This tool grinds piston pin holes and connecting rod bushings to accurate, round, hard, full bearing surface of mirror finish. Job is completed in a fraction of the time required by expansion reamers. Has a range of 47/64" to 1 5/16". Tool is easily expanded by pressing the push expansion knob.

An outstanding feature of the Sure-Mike is the lock screw, which when tightened, permits the tool to be locked at any size. Once

AMMCO PISTON PIN HOLE GRINDER

locked, all cylinders can be ground to correct size without further adjustment. Correct size pistons and rings can then be ordered by miking the expanding plates, or by simply sending the Sure-Mike to the jobber who can check the gauge and provide proper size pistons and rings.

Standard range 2⅝" to 4¾".

Improved Dry Grinder

The most outstanding feature of the Ammco grinder is the self-lubricating principle incorporated in the stones and buffing guides. The grinder removes metal at high speed and provides the mirror finish necessary for long piston ring wear. Besides this, the new grinder eliminates flying dust. The dust, being loaded with dry lubricant, is controlled for quick, easy cleanup. No vacuum cleaner is needed.

Its ease of operation with any ½" standard or special electric drill, the complete range, 2 11/16" to 4⅛" and its low price of $29.00, complete, are among the other noteworthy features of the new tool.

AMMCO DRY GRINDER

REFRIGERATION LABORATORIES

REFRIGERATION SERVICE LABORATORIES, INC., of which Mr. E. I. Dessent is President, Chicago, have just equipped a complete laboratory for the servicing and rebuilding of all makes of thermostatic controls, American Radiator expansion valves, and Penn and Apex water regulating valves.

This laboratory occupies four thousand square feet of space, and is equipped with the most modern devices, tools and testing apparatus obtainable.

In the Thermostatic Control Department, Mr. E. I. Dessent has designed the equipment used, which is reputed to be one of the most complete and accurate in the country.

In the Expansion Valve Department, all the jigs, discs and tools were purchased from the American Radiator Company, who supervised the layout of this department, which is a reproduction of their service repair department in Detroit.

The Water Regulating Valve Department, likewise, is thoroughly equipped to rebuild, check and adjust valves under actual operating conditions. The methods used in the various departments of the laboratory are so thorough that when the parts are returned to the customer, they have all the appearance and characteristics of brand new parts.

Mr. Dessent is also the head of the Copeland Refrigeration Service Company located at 61 E. Austin Ave., Chicago, where one of the most complete service stations is being maintained for the rebuilding and servicing of Copeland household and commercial equipment.

The Refrigeration Service Laboratories carry in stock, a complete line of American Radiator valves, Penn commercial and household controls and water regulating valves, Gilmer belts, Howell capacity non-radio interference motors, Methyl Chloride, and Isobutane (Freezol).

Complete literature and price lists will be mailed by the Refrigeration Service Laboratories on request.

FEDDERS BRANCH OPENED IN DALLAS, TEXAS

THE opening of a new Fedders Factory Branch in Dallas further extends Fedders policy of service through placing a large warehouse stock of Fedders standard refrigeration appliances and automobile radiator covers in the heart of the southwest territory. It also places Fedders Factory Engineering and Sales Service at the command of the trade.

LEO J. FREITAS

Leo J. Freitas has been appointed manager. His long experience in the Development, Engineering and Sales Departments of the Fedders factory equips him to give fullest cooperation to the refrigeration field in meeting their installation and production problems.

This new Fedders Factory Branch and Warehouse is located at 209 S. Pearl St., Dallas. Stock includes an extensive line of Fedders non-frost commercial evaporators, ice cube makers, household type evaporators and cooling units, force draft unit coolers, automatic and thermostatic expansion valves, beer coolers, beer pumps, as well as automobile radiator cores.

The Chicago office of The Fedders Mfg. Co., 603 Washington Blvd., will handle the company's line of refrigerating appliances direct for Milwaukee and adjacent territory formerly handled by J. H. Gugler.

S S S

KEROTEST DISTRIBUTOR

ROOT, NEAL & COMPANY, 64 Peabody Street, Buffalo, N. Y., has just been appointed distributors for Kerotest Refrigeration Valves, Manifolds, Accessories and Fittings in the Buffalo District.

S S S

MOVES

THE Refrigeration Accessory and Supply Company, formerly located at 642 Beaubien St., Detroit, has moved to new and larger quarters at 919 Holden Avenue. Better parking facilities, increased stocks and larger store and showrooms, including complete stocks of Kerotest Refrigerator Valves and Fittings will be features of the new location.

The Manager, Mr. J. M. Oberc, is Secretary of the Detroit chapter of the Refrigeration Service Engineers Society, recently formed to further educational activities of the National organization.

S S S

MR. E. P. WELLINGTON, formerly with Rempe Co., Chicago, has resigned to enter business for himself.

REVISED ORDINANCE

FROM the *Liquid Line* published by Refrigeration Service, Inc., Los Angeles, we learn of a revision in the Los Angeles electrical ordinance as it effects the installation and replacing of refrigerating equipment.

A successful effort to obtain certain exemptions to the new electrical ordinance was originated by A. W. Wicks, Heating and Ventilating Engineer, and resulted in the following letter, dated April 18th:

Dear Sir:

For your information I am in receipt of the following communication from the Board of Building and Safety Commissioners, under date of April 12th.

"At a regular meeting of the Building and Safety Commission held this date petition was received from the Registered Refrigeration Contractors requesting that the Electrical Ordinance be amended so as to allow refrigeration contractors to do the following work without electrical permits:

1. Connect, repair, remove and replace motors which are a portion of any unit refrigerator or refrigerating system as defined in section 230 of the building ordinance.

2. Connect, repair, reconstruct and replace electrically controlled switches which are a portion of any such unit refrigerator or refrigerating system.

After due consideration by the Board the following resolution was adopted:

RESOLVED that petitioners be exempted from the proposed rulings relative to the Electrical Ordinance insofar as this ruling would require permits for the above described work, and the matter be referred to Messrs. C. V. Welch, R. H. Manahan and A. B. Wicks to prepare an amendment to the Electrical Ordinance which would insofar as possible grant refrigeration contractors the privilege requested in the enclosed communication."

Should you desire further information please communicate with the writer, Room 200, City Hall, Phone Mi. 5211, Station 787.

Signed, J. J. Backus, Supt. of Building, by A. B. Wicks, Heating and Ventilating Engr.

S S S

D. C. Lingo,
Texas.

"I am an enthusiastic reader of your magazine. It is good—to the point and not too large. I have spread your order postals throughout my trade and you should have a number of readers through my efforts."

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

PERSONNEL OF OFFICERS OF SOCIETY ANNOUNCED

THE committee charged with the organization of the Refrigeration Service Engineers' Society has announced the completion of the personnel of the National Officers and the National Board of Directors, which was submitted to President Herbert Herkimer and approved. The National Officers and Board of Directors, who will serve until the first national meeting, or until their successors have been elected and qualified, are as follows:

PRESIDENT—Herbert Herkimer, 1819 Broadway, New York City.

FIRST VICE-PRESIDENT—T. J. Fowler, Associated Refrigeration Management, 514 Wenonah Ave., Oak Park, Ill.

SECOND VICE-PRESIDENT—Walter W. Kempf, Park Engineering Co., 355 Park Ave., Newark, N. J.

SECRETARY—H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

TREASURER—E. J. Merenda, M & R Refrigeration Service, 7412 19th Ave., Brooklyn, N. Y.

SERGEANT-AT-ARMS—James H. Downs, Downs Service, 2552 Blaine Ave., Detroit, Mich.

BOARD OF DIRECTORS—A. Jerome Robins, Frigid Refrigeration Service Corp., 3133 Olive St., St. Louis, Mo.; G. D. Wang, W-M Refrigeration Co., 2515 North 3rd St., Milwaukee, Wis.; Harry D. Busby, Harby Refrigeration Co., 5613 Lawrence Ave., Chicago, Ill.

The personnel of the Educational and Examining Board and the Membership Committee is expected to be announced in the June issue.

Meetings of Chapters

St. Louis Chapter No. 1

Meeting of April 12

ST. LOUIS Chapter held its regular meeting in the David Ranken, Jr., School of Mechanical Trades, with President A. Jerome Robins presiding. President Robins expressed his gratitude to the men who were responsible for the new faces at this meeting, and the prize for bringing in the first paid-up member was won by Mr. John Eichorn, who graciously turned it back for further use. Honorable mention was extended to Messrs. Eckhold, Hawkins and McDowell.

The idea of each member wearing an identification button, as described elsewhere in this issue, conceived by E. A. Plesskott, secretary, met with the hearty approval of all.

Mr. Pennington spoke briefly on the matter of credit and credit losses, and that of selling parts at list prices was discussed by Mr. Robins.

A bi-monthly Membership Committee was appointed by President Robins, consisting of the following: Messrs. Marshall, Petri, Lullman, Gray, Meeker and Frazier.

Meeting of April 26

Mr. Brown, of Brass & Copper Sales Co., Mr. E. Gygax, of the Curtis Manufacturing Co., and Mr. E. Zeller, of Zeller Electric Co., discussed topics of interest to the members.

Mr. Plesskott, secretary, showed a copy of a sign which he had prepared, which was to be posted in the various places where refrigeration service men would be likely to see it. The sign which is used is as follows:

ATTENTION!
Refrigeration Service Men!
St. Louis Chapter
R. S. E. S.
(Refrigeration Service Engineers' Society)
Meets 2nd & 4th Thursdays of Month
IT WILL BE TO YOUR ADVANTAGE TO IDENTIFY YOURSELF WITH THIS UP AND COMING ORGANIZATION
For Further Information
See:
Mr. ..... at this office, or
communicate with the Secretary
Mr. E. A. Plesskott, 2145—67th St.,
MU. 0231

It was also decided that at the meeting of May 10 a definite time would be set for the charter night, at which time St. Louis Chapter will formally receive its charter.

New York Chapter No. 1

Meeting of April 6

A SPECIAL meeting of New York Chapter was held on April 6, at which time the members of the chapter were invited guests of New York Chapter of the National Association of Practical Refrigerating Engineers, on an inspection trip through the remodeled and enlarged plant of the F. & M. Schaefer Brewing Co.

Mr. Frank O. Rickers, technical assistant of the brewery, Mr. Charles R. Neeson, chief engineer, Waldemar Mortensen, brewery architect, who planned and supervised all the improvements, conducted the visitors in two groups through the entire plant.

The F. & M. Schaefer Brewing Co. is one of the oldest breweries in the United States, having been established in New York in 1842. The inspection tour was a most interesting one to the members of the Society, to see the operation of a large ammonia refrigerating plant.

President Herkimer announced that New York Chapter has employed certified accountants, who are to investigate and install a uniform system for a single proprietor and partnership independent service organization. The expense incurred will be donated and presented to the National Society by New York Chapter, after the completion of the report is submitted to New York Chapter, which will be turned over to the National organization for further discussion.

Northern New Jersey Chapter No. 1

Meeting of March 28

THE meeting of Northern New Jersey Chapter No. 1 was held in the offices of the McIntire Connector Co., Newark, N. J., with President Hummelt presiding.

The Committee on Standards reported through Mr. Kempf that they could not adopt the standards as reported by the other chapters, under present conditions, and submitted the following scale of prices as fair for that territory:

Sulphur dioxide, apartments and commercial	@	$0.40 per lb.
Sulphur dioxide, domestic	@	.75 per lb.
Sulphur dioxide, domestic over 5 lbs.	@	.60 per lb.
Methyl chloride, apartments and commercial	@	1.25 per lb.
Methyl chloride, domestic	@	1.50 per lb.
Butane	@	3.50 per lb.
Ammonia, the standard price prevailing	@	.50 per lb.
Freon, price left open to the individual idea		
Labor to be charged for at the rate of		$1.50 per hr.

It was also moved and seconded that some arrangement of a credit file should be available, whereby accounts that were not satis-

factory could be filed and available for the use of members.

Meeting of April 11

Northern New Jersey Chapter, on the anniversary of the first year of its formation, April 11, held a special meeting, preceded by a dinner, at Schwartz's Restaurant, Hoboken, N. J., with President Hummelt presiding. A representative gathering attended in spite of the inclement weather.

National Secretary H. T. McDermott was introduced, and after every one had partaken of the dinner, Northern New Jersey Chapter was presented formally with its charter.

President Herbert Herkimer of the National Society acted as toastmaster and the meeting adjourned at a late hour, after a most enjoyable evening.

Chicago Chapter No. 1

Meeting of April 10

THE meeting was called to order by President T. J. Fowler, who disposed of the usual business of the chapter and turned the meeting over to Mr. C. E. Hamilton, chairman of the Educational Committee, who introduced Dr. E. Vernon Hill, president of the E. Vernon Hill Co., air conditioning specialist. Dr. Hill gave a most interesting address on air conditioning, which was illustrated by stereopticon views.

A motion was favorably passed upon that the chapter should consider the holding of a picnic this year, and Mr. R. B. Vanston was appointed chairman to secure information on desirable locations, and other arrangements that could be made.

Meeting of April 24

The meeting was called to order and after the usual business was taken care of, Mr. C. E. Hamilton introduced Mr. G. C. Taylor, district sales representative, Kerotest Manufacturing Co., who talked on the various products that their company manufactures.

President Fowler announced the appointment of Mr. Ivar Skipple as an additional member of the Educational Committee.

Questions in the Question Box were answered by Mr. Hamilton, and further discussion by the members on servicing prob-

KEROTEST VALVES AND FITTINGS.. are as near as your telephone

Yes Sir—you don't have to look far to find a ready supply of genuine Kerotest Refrigerator Valves and Fittings. If you are located in any of the principal cities of the United States or Canada, just consult the classified section of your local phone Directory under "Refrigerator Valves."
The Kerotest line is the most complete in the field and incorporates features of design found in no other refrigerator valves.
Write for Valve Catalogue No. 6 and Fittings Bulletin No. 1—valuable handbooks of information for every refrigerator service engineer.

Kerotest Manufacturing Company

2531 Liberty Avenue
Pittsburgh, Pa.

KEROTEST

The Matheson Co.

East Rutherford, N. J.

REFRIGERANTS

ARTIC
(Methyl Chloride)
ETHYL CHLORIDE
SULFUR DIOXIDE
ISOBUTANE
(Freezol)
AMMONIA
CARBON DIOXIDE

We Want Distributors

for the best beer cooling equipment on the market

● The Radial Dual Control Liquid Cooler has a combination of features found in no other beer cooling equipment. Positive temperature control . . . Wide range of temperatures . . . Capacity for all demands . . . Compact . . . Economical . . . Safe . . . Sanitary . . . Uses any refrigerant . . . One to four draft arms.

Wire or write today for details on a franchise in your territory.

Commercial Coil & Refrigeration Co.
455 N. Artesian Ave. - - - CHICAGO

SUPPLIES—PARTS—
COILS—CHEMICALS—
MATERIALS—UNITS

REFRIGERATION SPECIALTIES
"With Estimating Service for Service Engineers"

SERVICEMEN SUPPLY CO.
1819 Broadway, NEW YORK CITY
WRITE FOR NEW PRICE LIST

lems was participated in, after which the meeting adjourned.

Detroit Chapter No. 1

Meeting of April 4

PRESIDENT J. DOWNS presided at the meeting of Detroit Chapter, and Mr. George Clark, chairman of Detroit Chapter's Educational Committee, was delegated to investigate the local proposed code. A committee was also appointed to collect and disseminate information and to report at the meeting to be held in May.

The Chicago and Detroit codes were discussed item for item at the meeting of March 21, and particularly as the various features affect the welfare of the independent service engineer.

A motion was made and favorably acted upon that Mr. George Clark would contact, either in person or by correspondence, the prominent concerns engaged in the industry, with the view of obtaining their cooperation.

In order to further identify the service individuals of Detroit Chapter, it has been decided that all members equip themselves with a uniform overall bearing the inscription or emblem of the Society, and with further identification as to the company he represents.

Group advertising was also discussed, and preparations are under way whereby members will contribute to the advertising fund. Details of this activity are being worked out. It is proposed that the advertisement will be headed by the seal of the Society, under which will be listed the members of Detroit Chapter; suggesting that the purchaser of refrigeration service, interested in thorough, efficient and reliable service, should consult any listed refrigeration service engineer.

At this meeting the chairman of the Educational Committee arranged to have Mr. D. A. Newton, of the Universal Cooler Corp., address Detroit Chapter on air conditioning. Mr. Newton's address was very complete, and even extended to the details of how an air conditioning installation is calculated.

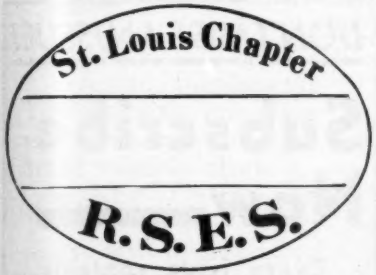
Detroit Chapter held a most successful card and dance party on April 7 in the ball-

room of Tuller Hotel, which was attended by some 300 persons, and of utmost importance was the fact that this party served as an excellent gathering for all of the members to become better acquainted. The affair consisted of a bridge party followed by dancing to a splendid orchestra, and lasted until the wee small hours.

S S S

ST. LOUIS CHAPTER MEMBERS IDENTIFIED

IN order to better acquaint the members with each other, E. A. Plesskott, secretary



IDENTIFICATION BADGE FOR ST. LOUIS CHAPTER MEMBERS

of the chapter, has devised a novel method. Each member has a large lithographed badge with his name lettered thereon, which he wears during the meeting. After the

meeting each member replaces his badge to its assigned place on a stand which Secretary Plesskott has constructed and which folds into a small size. The illustrations show the badge which is approximately actual size and the board.

CYLINDER SIZES TO MEET EVERY SERVICE NEED

Ansul Sulphur Dioxide

Available in 5, 10, 25, 70, 100 and 150 lb. cylinders, ton drums and tank cars. Every container analyzed to assure highest quality.

Ansul Methyl Chloride

Available in 3, 6, 15, 40, 60, 90 and 130 lb. cylinders. Low moisture and acid content guaranteed by analysis of every container.

ANSUL CHEMICAL CO.
MARINETTE - WISCONSIN

Herkimer Institute
"Makers of All-Make Service Men"
1819 Broadway New York City
"A Practical Trade School"
New models and new refrigerants do not up-set service departments manned by "Herkimer trained" service mechanics. Competent men available for all localities. Dealers, Service Managers, Manufacturers, when in need of reliable service men—
Write, phone or wire—no obligations.

REPLACEMENT PARTS For Frigidaires
Eccentrics—Connecting Rods—Shafts—Pistons—Pins—Rings—Gaskets—Flapper Blades and Discs also
Gaskets for Kelvinator and Servel.
ALL GASES—BELTS—TUBING—FITTINGS—TOOLS
Iceless Refrigeration Accessories Co.
2401-15 Chestnut Street, Philadelphia, Pa.

IMMEDIATE REACTION!

A Turner Halide Detector will instantly locate the slightest leakage (will detect seepage at the rate of only one pound in 7½ years) of Any Chlorinated Hydrocarbon Refrigerant.

Used and indorsed by leading refrigerator manufacturers and service men everywhere. Saves time—easy to handle and operate. Your jobber can supply you or Write for Catalog and prices.

THE TURNER BRASS WORKS
Dept. S-5 SYCAMORE, ILL.

The SERVICE MAN'S PROBLEMS are OUR problems

We welcome inquiries from Service Engineers regarding any difficult problem. We maintain a FREE Advisory Service to help you solve them. Consult us—any time.

Extra Dry
ESOTOO
(Liquid Sulphur Dioxide)
and
V-METH-L
(Virginia Methyl Chloride)

Will simplify many of the refrigerating problems that confront the Service Engineer.

Write for descriptive folders.

VIRGINIA SMELTING Co.
WEST NORFOLK, VA.
76 BEAVER ST., N.Y. 131 STATE ST., BOSTON

DON'T MISS AN ISSUE!

Subscribe Now——

Every issue contains ideas you can use—don't miss an issue. If you are not a subscriber—don't delay sending your subscription. Every issue brings you practical information and helps you can use every day

COPELAND REPAIRS—REPLACEMENTS

REPAIRS		REPLACEMENT PARTS	
B & B Household Controls	$2.50	Howell Special Capacitor Type ¼ HP Refrigerator Motor	$11.00
Penn Household Controls	2.50	Amer. Rad. Household Exp. Valve	4.50
Penn Commercial Controls	4.50	Amer. Rad. Multiple Exp. Valve	7.50
Amer. Rad. Household Exp. Valve	2.50	Penn Commercial Controls	$8 & $12.00
Amer. Rad. Multiple Exp. Valve	3.50	Iso Butane (Freezol), Per lb.	1.25
Apex Water Regulating Valve	3.50	Methyl Chloride, Per lb.	.70
Penn Water Regulating Valve	3.50		

We also carry a complete stock of Gilmer Belts, Penn Water Regulating Valves, Glass Defrosting Trays, Lead and Fibre Gaskets, Etc. WRITE FOR PRICES.

Forty Eight Hour service on repairs, immediate shipment on replacements. All Repairs and Parts guaranteed to be free from defects in Workmanship, and Material for ONE YEAR.

REFRIGERATION SERVICE LABORATORIES, INC.
418-20 Rush Street Chicago, Illinois

A Convenient Binder

for the Educational Material of the Service Engineers' Society

EVERY member of the Society should have one of these binders, as it provides a convenient method of using the educational material sent out by the Society, and also published in THE REFRIGERATION SERVICE ENGINEER.

In this and past issues of THE REFRIGERATION SERVICE ENGINEER are published valuable charts — Complaint Charts and Trouble Chart. Other charts will be published in succeeding issues. Provision is made so that these charts can be cut out of this issue and filed conveniently in the new binder. You should have a binder immediately, so that the charts appearing in this issue will provide a start for your handy reference book. It is attractively stamped on the front cover with the Society's name.

Size 4½ in. x 7½ in. Holds Standard 3¾ in. x 6¾ in. sheet.

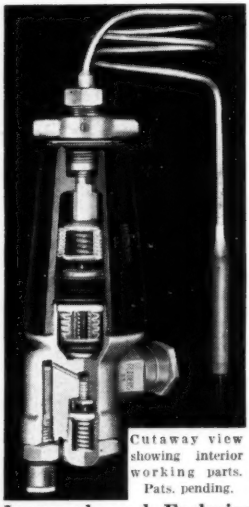
This flexible leather, six-ring binder is designed so that it can be conveniently carried in the pocket and used on the job every day. The educational material sent to each member of the Society will be designed so as to fit this convenient binder, also tables, charts and other valuable data published in THE REFRIGERATION SERVICE ENGINEER. A supply of ruled memorandum paper for making notes and sketches is furnished. The educational material published in THE REFRIGERATION SERVICE ENGINEER and that sent out by the Society will provide a valuable reference book that will be an indispensable help in solving every day servicing problems.

SEND REMITTANCE OF $1.00 TO THE

REFRIGERATION SERVICE ENGINEERS' SOCIETY

433 North Waller Avenue **CHICAGO, ILL.**

HOW FEDDERS APPLIANCES ARE DESIGNED ESPECIALLY for Installation and Service ENGINEERS

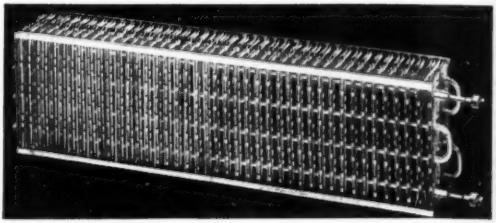


Cutaway view showing interior working parts. Pats. pending.

Designed for quick installation and easy accessibility. Fedders Appliances incorporate many years of practical experience in the field. They are built to save time and money for Refrigeration Service Engineers.

FEDDERS NON-FROST EVAPORATORS With Copper Fins Fused to Copper Tubes

Made in over a thousand sizes with Fluted and Flat Fins. Flat Fins as shallow as 1¼" high. Made for all refrigerants, INCLUDING AMMONIA. Write for Bulletin 40.

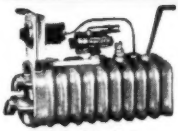


Improved and Exclusive Features of FEDDERS Model 33 Thermostatic Expansion Valve

1. Interchangeable Power Element Bellows, Tube and Bulb Assembly.
2. Hermetically Sealed Power Element Housing.
3. Adjustable without breaking Hermetic Seal.
4. Power Element Bellows Assembly can be changed anywhere, any time.
5. Drop Forged Brass Valve Body.

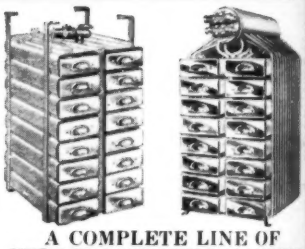
Makes a COMPLETE LOW SIDE ASSEMBLY. Write for Bulletin 67A.

FEDDERS MODEL 9940 AUTOMATIC EXPANSION VALVE for use with all refrigerants except ammonia.



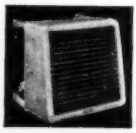
FEDDERS PRESTALLOY EVAPORATORS

Made of Copper and Brass throughout. Beautiful one-piece design requires no shields, 2, 3 and 4 Tray sizes.



A COMPLETE LINE OF FEDDERS ICE CUBE MAKERS

Repeal has brought a big demand on Ice Cube Makers. Flooded and Dry Expansion Models in every capacity up to 576 ice cubes weighing 55 lbs. per freezing.



← **FEDDERS FORCEDRAFT UNIT COOLERS**

with Fedders exclusive Inclined Element providing hundreds of water troughs which maintain correct relative humidity.

FEDDERS
MANUFACTURING CO.,
57 Tonawanda Street
Buffalo, N. Y.

300 Fourth Avenue, New York
603 W. Washington Blvd., Chicago
222 E. Ninth St., Cincinnati
209 S. Pearl St., Dallas
923 E. Third St., Los Angeles

ARE YOU GETTING YOUR COPY OF THE FEDDERS NEWS?